Summary:

The IoT-based Solar PV Water Pumping System is a new project that aims to efficiently pump water for diverse agricultural, residential, and commercial applications by utilizing the power of solar energy. This project employs an alternating current (AC) motor in conjunction with Internet of Things (IoT) technology to give a smart and controlled solution for water pumping.

A solar photovoltaic (PV) array transforms sunlight into power, and an AC motor-driven water pump is part of the system. The internet of things component enables the water pumping system to be monitored, controlled, and improved in real time. Several sensors are used to collect data on characteristics such as DC voltage, frequency, and temperature, which provides significant insights into system operation. The IoT platform provides an overview for data collecting and processing, making it easier.

A user-friendly interface allows access to monitor and control of the system. Users can monitor the system's performance parameters as needed by utilizing IoT capabilities, providing optimal efficiency and reliability.

System Block Diagram

Determine the water pump's power requirements: Before designing the solar-based water pumping system, it is important to determine the power requirements of the water pump. In our case, we used a water pump that requires 750W of power, so we sized the solar panels and inverter accordingly.

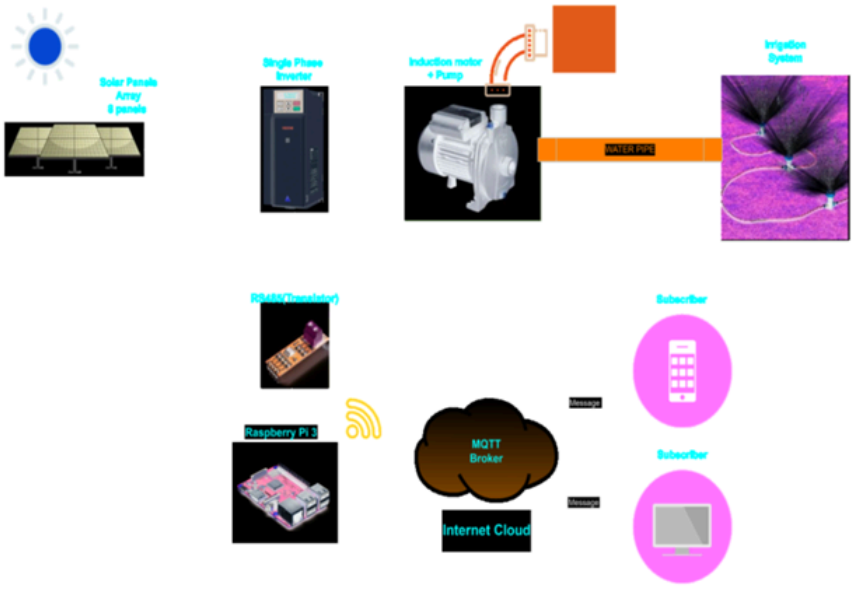

Figure 1: Proposed System

Selecting the solar panels: we used eight solar panels of Monocrystalline type with adjusting the optimal Azimuth angle for Solar Panels. To accomplish better performance and power generation with 41.5V at maximum power point for each. Assuming that each solar panel has a power output of 450W at the maximum power point, the total power output of the eight solar panels will be 3.6kW. This power output can power a 750W water pump and provide enough power for the inverter. However, it is important to confirm the specifications of the solar panels to ensure that they are compatible with the inverter.

Selecting the inverter: To convert the DC power from the solar panels into AC power to power the water pump, you need an inverter. Since the water pump requires 220V AC power, it is necessary to select an inverter that can provide at least 150V DC input and produce 220V AC output with 60Hz frequency. And we also need to ensure that the inverter can handle the power output of the solar panels and the power requirements of the water pump.

Designing the control system: To automate the water pumping system and make it smart, we used a Raspberry Pi. The Raspberry Pi can be programmed to send and receive data to allow monitoring and controlling the inverter's operation and turn on and off the water pump based on the irrigation requirements. We also added the water flow control feature which allows the user to increase or decrease the water flow rate by changing the frequency of the inverter output. We also added sensors to monitor the moisture of the soil and the temperature of the panels to adjust the water pump's operation accordingly

Assembling and testing the system: After selecting the required components, we assembled the whole structure of the panels and fixed the electronics with wiring of the entire system, installed the water pump, and tested the system's performance. We monitored the system's performance and made any necessary adjustments to ensure that it meets the irrigation requirements.